(12) UK Patent Application (19) GB (11) 2070675 A

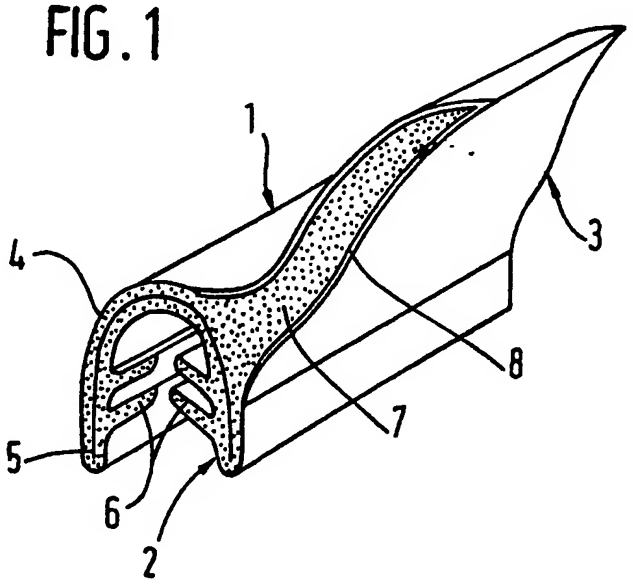
(21) Application No 8102316
(22) Date of filing
26 Jan 1981
(30) Priority data
(31) 20251
(32) 29 Feb 1980
(33) Italy (IT)
(43) Application published
9 Sep 1981
(51) INT CL³ E06B 7/23
(52) Domestic classification
E1J Gn
(56) Documents cited
GB 1542283
GB 1540063
GB 1330974
GB 1044475
GB 1014469
GB 958285
GB 944185
(58) Field of search
E1J
(71) Applicant
Industrie Pirelli SpA
Piazzale Cadorna 5
Milan
Italy
(72) Inventor
Achille Gallizia
(74) Agents
R E S Waller
2 Parade
Sutton Coldfield
West Midlands B72 1PF

(54) Sealing strip for a vehicle door opening

(57) A sealing strip, e.g. for surrounding and sealing a door opening in a motor vehicle, comprises a first portion (2) which grips a flange and a second portion (3) made of a foamed elastomeric material (7) which forms the seal and may have a skin (8) having a low coefficient of friction.

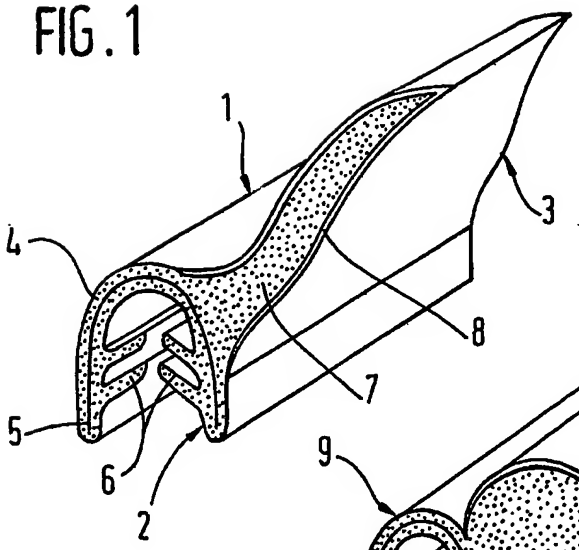
A mould for making the sealing strip is described.

FIG. 1



GB 2070675 A

FIG. 1



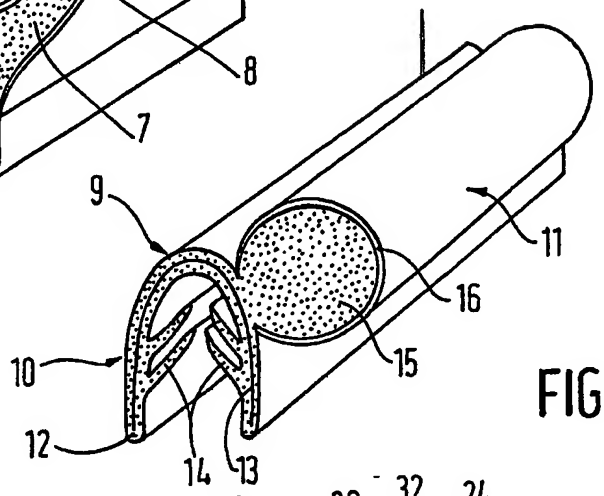


FIG. 2

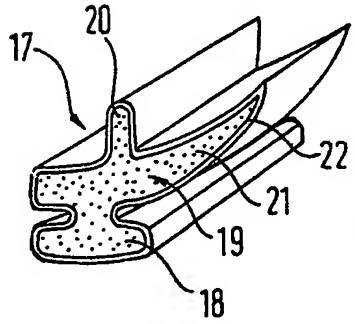


FIG. 3

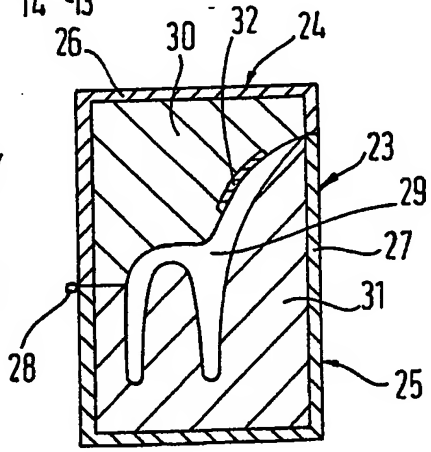


FIG. 4

SPECIFICATION

Sealing strip and mould for its manufacture

The present invention relates to a sealing strip, in particular to a sealing strip for surrounding apertures in motor vehicles so as to provide a seal when the apertures are closed by means of a suitable element, and to a mould for manufacturing such sealing strips.

Known sealing strips are generally made from one or more elastomeric materials and comprise at least one portion, made of a foamed elastomeric material, which is capable of being deformed so as to provide a seal in abutment against the closure element and a second portion which has a rigid insert embedded therein so as to permit anchorage of the strip around the aperture. These known strips have several disadvantages, including that of requiring a high degree of compression between abutting surfaces to make a good seal. The proportion of voids in the foamed part of the known strips does not normally exceed 50%, and this imparts a high rigidity to the strips.

Consequently, when the deformable portion of a known strip is compressed, said portion is deformed transversely relative to the body of the strip and this reduces its sealing efficiency.

It has been proposed to place mechanical stops on either side of the strip so as to prevent the body of the strip from being deformed in the transverse direction. Although these mechanical stops increase the pressure exerted against the closure element, we have found that they also cause wear and tear of the body of the strip, besides being complicated to make and expensive to produce.

Owing to the intrinsic characteristics of the elastomeric material comprising the strip it is necessary for the closure element to apply a very high compression to the deformable portion.

This very high compression leads to stresses in the elastomeric material. When the stresses are maintained and repeated for long periods, a premature loss of the characteristics of the elastomeric material results.

Known strips made of an elastomeric material are, moreover, subject to severe wear and also to tearing at those points where the closure element rubs against the strip.

Generally, the closure elements are made of metal. Since the rubber-to-metal coefficient of friction is very high, large stresses arise on the surface of the elastomeric material and this can lead to tearing.

Finally, the known strips are generally made by a continuous extrustion process and are subsequently cross-linked, or by moulding. In the latter case, the elastomeric material cross-links at high temperatures and, since it requires high moulding pressures, it is necessary to provide very expensive metal moulds whose use is limited to the production of strips having a fixed configuration. In addition, the metal moulds require ancillary equipment for the supply of pressure and heat thereto.

Thus, if it is desired to modify the shape of the strip it is necessary to construct a new mould.

Moreover, if the configuration of the strip is at all complicated (e.g. where more than one or two projections are to be provided) it is necessary to produce the strip in several parts and to assemble these parts by means of a moulding operation.

One object of the present invention is to provide a strip which does not have the drawbacks of the known strips, which can provide a seal under a low level of compression, which does not exhibit undue wear, and which can be produced in a single operation even if it is to have a complicated configuration.

A further object of the present invention is to provide a mould for the manufacture of a sealing strip, which can readily be modified in order to mould strips having different configurations.

Accordingly, the present invention provides a sealing strip for surrounding an aperture in a motor vehicle, the strip comprising at least one portion made of a foamed elastomeric material, said portion being provided with means for limiting its deformation under compressive forces.

The present invention also provides a mould for manufacturing a sealing strip as described in the immediately preceding paragraph, the mould comprising at least two mould halves which, when joined together, define a moulding cavity for the strip, in which the walls of said moulding cavity are made of a plastics material.

The present invention will be illustrated, merely by way of example, in the following description and with reference to the accompanying drawings. In the drawings:

Figures 1 and 2 show, partly in section and partly in perspective, two embodiments of a sealing strip according to the present invention;

Figure 3 shows, partly in perspective and partly in section, a further embodiment of a sealing strip according to the present invention;

Figure 4 shows, in section, a mould according to a preferred embodiment of the present invention.

Referring to Fig. 1, a strip 1 comprises a first portion 2 suitable for anchoring the strip to an opening and a second portion 3 (made of a foamed elastomeric material) and capable of being deformed by bending stresses so as to provide a seal around the opening.

The first portion 2 comprises a substantially

U-shaped body 4 made of polyurethane, in which is embedded a reinforcing insert 5. Said insert 5 may comprise a metal strip provided with perforations.

The insert 5 supplies to said first portion a suitable deformability so that it can be anchored to the sides of the opening in which the strip is to be installed.

In order to make said anchorage more reliable, the concave portion of the U-shaped body 4 may be provided with continuous projections 6.

Alternatively, the U-shaped body 4 can be made of an elastomeric material.

Sealing strips according to the present invention may be partly or wholly covered with a textile, with synthetic fibres or with strips of fabric.

Portion 3 (made of a foamed material) can be deformed so as to provide a seal against the closure element. Said portion 3 projects from said first portion 2 and comprises a tongue 7, which is made of foamed polyurethane material and which is provided with means for limiting its deformation.

The means for limiting the deformation of portion 3 can also act as means for reducing the coefficient of friction of the surface of said portion 3.

One embodiment of such means for limiting the deformation and reducing the coefficient of surface friction comprises a compact polyurethane skin 8 which covers the tongue 7.

Said skin 8 can have a uniform thickness along the entire length of the strip or can have a variable thickness, both along the length of the strip and from point to point in the same portion of the strip.

Referring to Fig. 2, a strip 9 is provided with a reinforcing insert. Said strip 9 comprises a first portion 10 suitable for anchoring the strip to the sides of an opening to which it is to be applied and a second portion 11 suitable for effecting a seal.

Said portion 10 comprises a substantially U-shaped body 12 of polyurethane or of an elastomeric or a plastics material. Said U-shaped body 12 is provided with a reinforcing insert 13 of the type described hereinabove with reference to Fig. 1. The concave portion of said U-shaped body 12 is provided with projections 14 to facilitate the anchorage of portion 10, and consequently of the whole strip, around the opening.

Said portion 11, which is adapted to effect a seal by compression, comprises a mass 15 of foamed polyurethane.

The means suitable to limit the deformation of the mass 15 and to reduce the coefficient of friction of the surface of said portion 11 comprises a compact skin 16 of polyurethane. Said skin can have a thickness which varies, either from point to point along one portion, or along the whole length of the strip. Alternatively, said thickness can remain uniform along the entire length of the strip 9.

Fig. 3 shows a strip 17, without a reinforcing insert. Said strip 17 comprises a first portion 18 suitable for anchoring the strip to the sides of an opening and a second portion 19, provided with two projections 20 and 21, to effect the seal.

Said strip 17 is constituted by a unitary body of a foamed polyurethane and is provided with means for limiting the deformation of said body, as well as with means for limiting the coefficient of friction of the body. In the particular embodiment shown in Fig. 3, said means consist of a compact polyurethane skin 22.

Referring now to Fig. 4, there is shown a mould 23 comprising two mould halves 24 and 25, each of which is contained in a rigid envelope 26 and 27 respectively. The envelope 26 and 27 may be made of metal.

Said rigid envelopes 26 and 27 are hinged to each other by means shown schematically at 28.

When the two mould halves 24 and 25 are closed, a cavity 29 is defined inside the mould, said cavity having the shape of the strip to be produced in the mould 23. The walls of said cavity are formed by appropriately-shaped blocks 30 and 31 of a plastics material.

If the strip is to have some areas of the skin with greater thickness than the remainder, the walls of the mould are provided with means to achieve this.

A particular embodiment of said means comprises one or more metallic segments (one shown–32) said segment 32 substituting completely or partially (as shown in Fig. 4) the shaped plastics material of blocks 30 and 31.

Blocks 30 and 31 are releasably attached to the respective envelopes 26 and 27 by means known *per se*, for example screws (not shown in Fig. 4), so as to facilitate substitution of the blocks. Means, known *per se*, are also provided in order to maintain the two mould halves 24 and 25 in the closed condition during moulding.

If the strip has a particularly complex configuration, the mould may comprise more than two separable moulding portions.

The operation of the mould according to the present invention is as follows. (Reference is made to production of the strip shown in Fig. 1).

A pre-shaped article, obtained for example by extrusion, suitable for forming the first portion 2 of the strip, is inserted into the mould. Subsequently, a polyurethane-forming compound is added. After closing the mould, foaming of the polyurethane begins, with consequent formation of a compact skin around the second portion 3, i.e. on all those surfaces of portion 3 of the strip in contact with the walls of the mould.

Adhesive may be provided at the areas

tomeric material is made of polyurethane.

6. A mould for manufacturing sealing strips according to any one of Claims 1 to 5, the mould comprising at least two mould halves which when joined together define a moulding cavity for the strip, in which the walls of said moulding cavity are made of a plastics material.

7. A mould according to Claim 6, which includes means adapted to vary the thickness of the compact skin of the strip produced in said mould.

8. A sealing strip, substantially as hereinbefore described, with reference to and as illustrated in Fig. 1, 2 or 3 of the accompanying drawings.

9. A mould, substantially as hereinbefore described, with reference to and as illustrated in Fig. 4 of the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

which are to become the joint between portions 2 and 3 of the moulded strip.

The foaming of the polyurethane takes place by means of an exothermic reaction of the compound in the mould.

When a sufficient period of time has elapsed for foaming and cross-linking of the polyurethane, with formation of the compact skin and joining of the portions 2 and 3 of the strip, the mould is opened and the finished strip removed.

Alternatively, if the strip is of the type shown in Fig. 3, i.e. without the reinforcing insert, moulding takes place as follows.

A polyurethane-forming compound is placed in the mould, the mould is closed and said polyurethane compound is foamed. Alternatively, the polyurethane compound may be injected or cast inside the mould after the mould has been closed.

The polyurethane in contact with the walls of the mould will form a compact skin whose thichkness can be varied, where desired, by means described hereinabove.

Alternatively, the compact skin can be formed by spraying the surface of the mould with a suitable compound. Subsequently the polyurethane compound which forms the body of the strip is placed in the mould.

The compact skin of polyurethane provides, on that part of the strip which effects the seal, a very smooth surface which consequently permits rubbing contact with the closure element. The coefficient of friction between the metallic surface of the closure element and the compact skin of polyurethane is much lower than the coefficient of friction between a metallic surface and a rubber surface such as occurs in known strips.

This means that there will be less wear on the strip, which will consequently have a longer service life.

The compact polyurethane skin also forms two surface layers which are much more rigid than the foamed portion contained between said layers. These two layers provide the foamed portion of said strip with a greater resistance to deformation in response to the pressure exerted by the closure element on the strip.

In fact, whether said closure element acts by bending the foamed portion of the strip (as in Figs. 1 and 3) or by pressing said foamed portion (as in Fig. 2) the compact skin will cooperate to improve the seal.

In the first instance described in the immediately-preceding paragraph, the skin forms a sandwich which provides greater resistance to the bending forces imposed by the closure element than would be the case in the case of absence of such a skin.

In the second instance, the skin encircles said foamed portion of the strip so as to limit the expansion of said foamed portion in the direction perpendicular to the compression forces.

In this way a tight closure can be guaranteed even if the distance between the closure element and the sides of the aperture is non-uniform. Moreover, by varying the thickness of the compact skin, it is possible to provide individual points of the strip with greater or lesser resistance to bending or compressive forces.

Because of the use of foamed polyurethane, it is possible to attain relatively low densities, with consequent advantages of deformability of the strip and of light weight.

Strips according to the present invention have a proportion of voids which is higher than that of known strips.

Moreover, strips according to the present invention can be produced, (unlike known strips) in any colour, by adding appropriate pigments to the polyurethane-forming compound.

Moulds according to the present invention have walls, (which define the cavity wherein the strip is formed), of a shaped plastics material.

This permits the production of strips having very complicated configurations by only one operation.

If it is desired to produce a strip having a very complicated configuration by assembling a plurality of individual parts, the assembly is made easier by the fact that the individual parts can be joined together by means of an adhesive (as opposed to the use of presses or moulds).

Thus, the moulds according to the present invention are relatively inexpensive and very versatile, in addition to providing a very high degree of compactness and smoothness to the skin. Modification of the shape of the moulding cavity is also simplified. Consequently, the cost of moulds according to the present invention is very much reduced. Likewise, the production of strips having different shapes is facilitated.

CLAIMS

1. A sealing strip for surrounding an aperture in a motor vehicle, the strip comprising at least one portion made of a foamed elastomeric material, said portion being provided with means for limiting its deformation under compressive forces.

2. A strip according to Claim 1, said strip including means adapted to reduce the coefficient of friction of said portion.

3. A strip according to Claim 1 or 2, in which said means for limiting deformation and for reducing friction comprise a compact skin surrounding said portion.

4. A strip according to Claim 3, in which said compact skin has a non-uniform thickness.

5. A strip according to any one of the preceding claims, in which the foamed elas-